REMARKS

The Examiner's Action mailed on March 30, 2011, has been received and its contents carefully considered. In this Amendment, claim 1 is the only pending independent claim. Claims 12-13 have been added. Support for claim 12 may be found for example at ¶[0037] and support for new claim 13 may be found for example at ¶¶[0032]-[0033]. Claims 1-13 will be pending upon entry of this Amendment.

Claims 1 - 4, and 10 - 11 rejected under 35 U.S.C. 103(a) as being unpatentable over JP-A-250597 to Kageyama ("*Kageyama*"). Claims 5 - 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Kageyama* and in view of JP-A-57-69137 to Shimada ("*Shimada*").

The Examiner defines the claimed equation "$(k_L - 0.25)*(0.25 - k_R) = D_R / D_L$" as:

> "K = balance ratio, which equals $(M - W_{rot} * r/2) / (W_{rec} * r)$;
> M = total unbalanced quantity of crank web, (g*mm), which is the moment;
> r = rotational radius of W;
> W_{rot}= mass for rotating portion, grams;
> W_{rec} = mass for reciprocating portion, grams;
> D = distance from center of crankshaft to half crank web."

(Office Action, page 3). Firstly, ¶[[0032] discloses that "r denotes the rotational radius of W_{rot} and W_{rec}. r is 1/2 of a rotational circle of a crank pin and also 1/2 of a stroke of the reciprocating portion," rather than just the rotational radius of W. Furthermore it seems that the equation is $k=(M-W_{rot}*r/4)/(W_{rec}*r)$ (¶[0033]).

Kageyama is discussed in the published application at ¶¶[0003]-[0009]. *Kageyama* pertains to an engine for a vehicle in which a balancer (referred to as a primary balancer)

for constant velocity is provided for a crankshaft whose arrangement of each crank pin is, respectively, 0° for a first cylinder, 90° for a second cylinder, 270° for a third cylinder and 180° for a fourth cylinder (referred to as a two-plane 90° type) (¶[0004]). *Kageyama* discloses that the additional weight added to a crank web is 1/2 of the weight W_{rec} of the reciprocating portion, and that the weight of a crank web for each cylinder concentrates at the center of the cylinder (¶[0009]). Accordingly, the additional weight of each half crank web is assumed to be 1/4 of the weight of the reciprocating portion as a premise (¶[0009]).

On the basis of this premise, in *Kageyama*, an isotropic balancer rotating at a constant velocity in an isotropic direction with respect to the crankshaft is provided, in addition to a reverse balancer rotating at a constant velocity in a reverse direction with respect to the crankshaft, and a part of the weight $W_{rec}/2$ added to the crankshaft is divided for the isotropic balancer so that the addition weight of the crankshaft is made 1/2 of W_{rec} or less (¶[0009]). However, a balancer rotating in the isotropic direction and a balancer rotating in the reverse direction cause unavoidable increase in size of the engine (¶[0009]; *see* Drawing 3 of *Kageyama*).

In contrast, the present invention preferably uses just one primary balancer shaft in order to make the engine compact (¶[0037]). The couple balancer 6 removes the primary couple (i.e., the sum of vectors of the primary inertia force operating upon the respective crank pins 21 to 24) generated in accordance with rotation of the crankshaft 3 (¶¶[0047] and [0063]).

It seems that *Kageyama* operates on a wholly different system and under different assumptions (i.e., two crankshafts that operate under specific conditions) than the present invention (i.e., capable of using only one crankshaft). Therefore, there seems to be no reason why a person of ordinary skill in the art would modify the equation disclosed in formula 8 of *Kageyama* to arrive at the claimed invention.

Formula 8 seems to lack some of the features of the present invention, and it does not appear obvious to arrive at the claimed invention by modifying formula 8. For instance, the recited equation includes a balance ratio, which may be defined as $k=(M-W_{rot}*r/4)/(W_{rec}*r)$ (¶[0033]). W_{rot} is the mass of the rotation portion and W_{rec} is the mass for the reciprocating portion (¶[0031]). Formula 8 appears to relate to a calculation that sets the primary inertia force to 0 by mutually negating the vibration exciting moment in each cylinder (¶[0034]). Formula 8 does include calculating a mass m, but there is no indication that a ratio is taken, or that two different masses (i.e., W_{rot} and W_{rec}) are considered within a ratio.

While ¶[0022] discloses ratios A and B showing the assignment rate of the rotation partial mass of a crank shaft and direction balancers, such as uniform velocity, it is unclear whether these ratios are used in formula 8. However, applicant cannot find any reason why A and B would be included in formula 8.

Moreover, the balance ratios of the present invention relate to a crank web that is divided between a pair of half crank webs facing a crank pin, and wherein k_L, k_R denote balance ratios of the both half crank webs. Formula 8 seems to include calculations for

each cylinder, but does not seem to contemplate half crank webs, or calculating balance ratios for each half crank web (¶[0034]).

Furthermore, equation 8 does not include D_L, D_R which denote distances from the center in a longitudinal direction of the crankshaft to the respective half crank web. The Examiner asserts that "the distances of D from the center of the crank to the half crank web is outlined in Figure 2. One skilled in the art can infer that a half crank web can be measured within a crank web" (Office Action, page 4). Drawing 2 illustrates a crank arrangement of a 4-cylinder engine, but seems to lack any disclosure relating to distances (¶[0016]). Moreover, it seems that FIG. 2 illustrates each crank (20a, 20b, 20c, 20d), but does not seem to illustrate that half crank webs may be different distances from the center in a longitudinal direction of the crankshaft. Thus, *Kageyama* does not disclose or suggest all of the features of independent claim 1.

It is submitted that this application is in condition for allowance. Such action, and the passing of this case to issue are requested.

Should the Examiner feel that a conference would help to expedite the prosecution of this application, the Examiner is hereby invited to contact the undersigned counsel to arrange for such an interview.

Should any fee be required, the Director is hereby authorized to charge the fee to our Deposit Account No. 18-0002, and is requested to advise us accordingly.

Respectfully submitted,

June 22, 2011
Date

Robert H. Berdo, Jr.
Reg. No. 38,075
RABIN & BERDO, PC
Customer No. 23995
Telephone: 202-371-8976
Fax: 202-408-0924

RHB/SD/